



Formal Grammar of  
Vaisesika Ontology

# CROSSING THE LINE FROM ALCHEMY TO CHEMISTRY

You've turned lead into gold? Good.  
Do it again, write a detailed description  
of how you did it, and submit it to  
peer review.



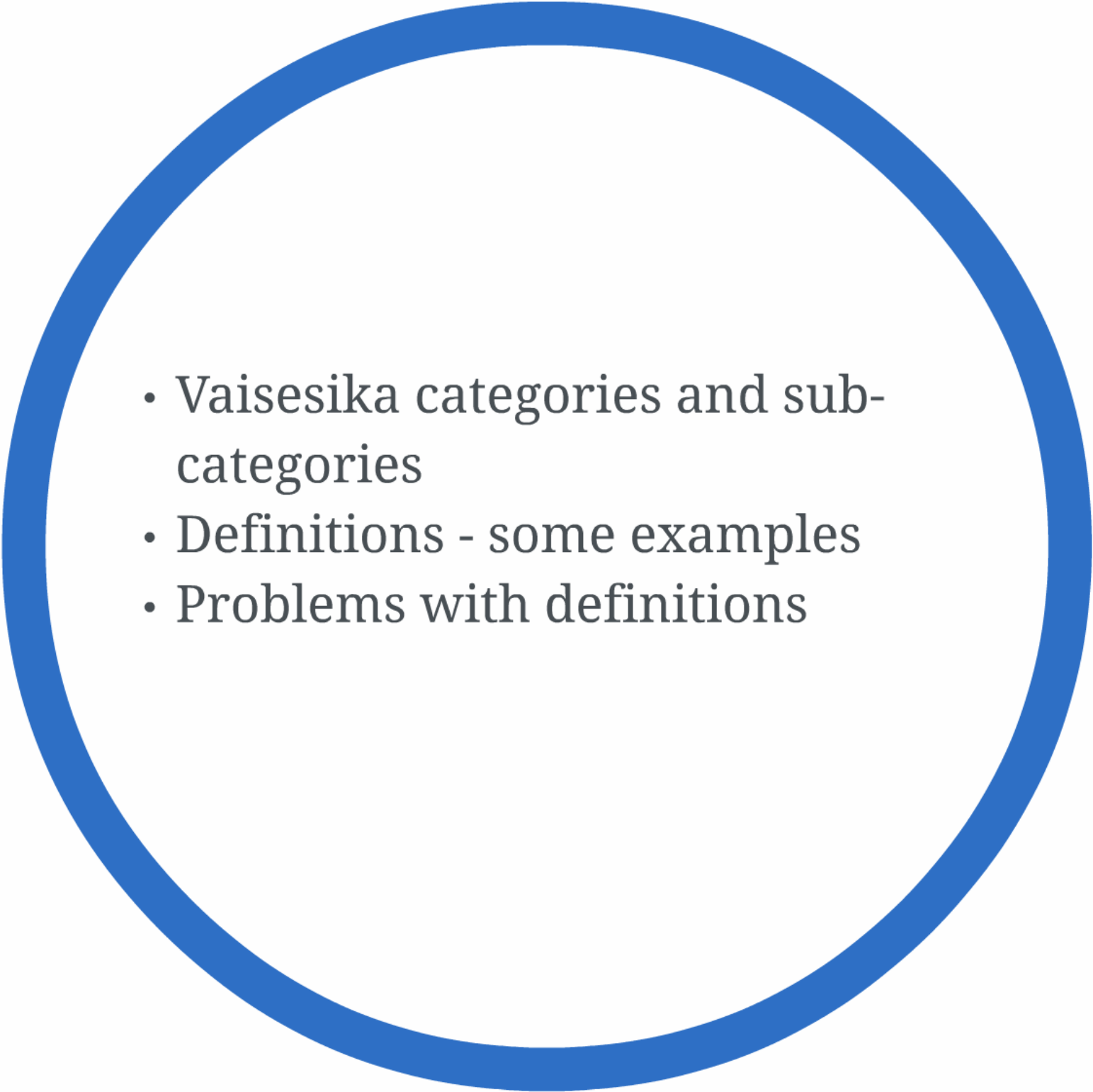
# Overview

- Formal Grammar ◉
- Vaisesika Ontology ◉
- NVFO (Neo-Vaisesika Formal Ontology) ◉
- G3 (Generative Graph Grammar Software) ◉

- What constitutes a grammar and what are related to it?
  - Language
  - Alphabet
  - Rules

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- Vaisesika categories and sub-categories
  - Definitions - some examples
  - Problems with definitions

# Overview

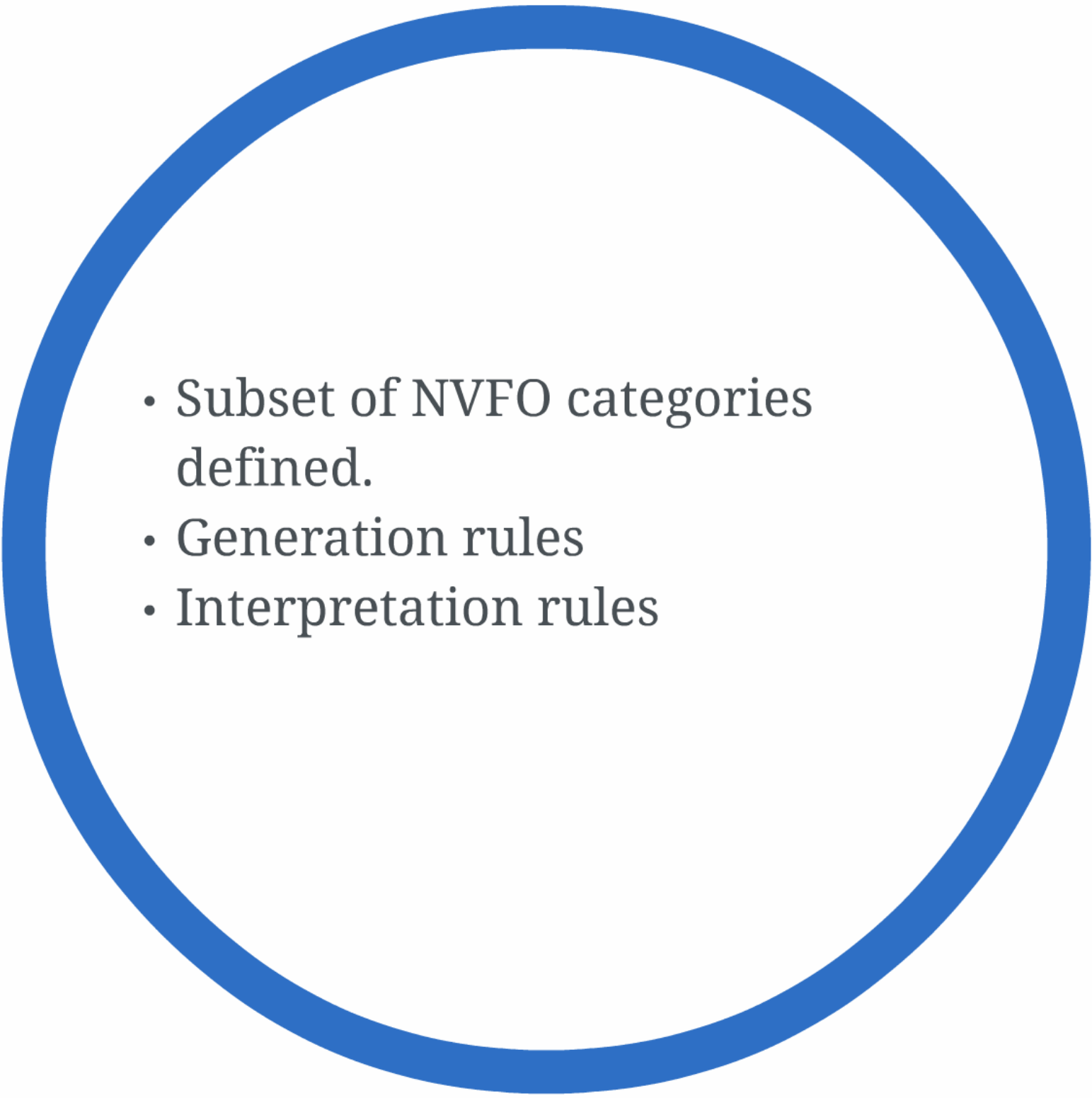
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- What makes it formal?
- How does it address the problems with Vaisesika definitions?
- Grammar
  - Alphabet
  - Language (valid NVFO graphs)



# Overview

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- 
- Subset of NVFO categories defined.
  - Generation rules
  - Interpretation rules

# Formal Grammar

## Example 1

Sentences in English:

- Ravi is at home.
- How are you?
- That's right!
- ...

Alphabet:

- {a, b, c, ..., Z, A, B, C, ..., Z, ?, !, .}

## Example 2

Alphabet = {a, b}

- L1 = {a, aa, aaa, aaaa, .....}
- L2 = {ab, aabb, aaabbb, ...}
- L3 = {bb, bab, baab, baaab, ...}
- L4 = {a, b, ab, aba, abb, ba, bb, bab, bba, ..., bbaabab, bbaabab, bbbbb, ababb}

G1:

S → SS | a

G2:

S → aSb | NULL

G3:

S → bAb

A → AA | a | NULL

G4:

S → SS | a | b | NULL

## Example 3

Alphabet = {0,1,2,3,4,5,6,7,8,9}

L = {0, 1, 2, ..., 21, 22, ..., 234234, ...}

Grammar:

N → NN | D

D → 0|1|2|...|8|9

Is "00052 = 52" ?

L = {0, 00, 000, ..., 5, 01, 002, ..., 3, 02, 005, ..., 01, 0011, ..., 2000, 00100, 000001, ...}

# *Example 1*

Sentences in English:

- Ravi is at home.
- How are you?
- That's right!
- ...

Alphabet:

- {a, b, c, ... z, A, B, C, ... Z, ?, !, .}

## Example 2

Alphabet = {a, b}

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- L4 = {a, b, ab, aba, abb, ba, bb, bab, bba, ..., bbaabab, bbbaabab, bbbbbb, ababb}

G1:

$S \rightarrow SS \mid a$

G2:

$S \rightarrow aSb \mid \text{NULL}$

G3:

$S \rightarrow bAb$

$A \rightarrow AA \mid a \mid \text{NULL}$

G4:

$S \rightarrow SS \mid a \mid b \mid \text{NULL}$

G1:

$S \rightarrow SS \mid a$

G2:

$S \rightarrow aSb \mid \text{NULL}$

## Example 2

Alphabet = {a, b}

- L1 = {a, aa, aaa, aaaa, .....}
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- L4 = {a, b, ab, aba, abb, ba, bb, bab, bba, ..., bbaabab, bbbaabab, bbbbbb, ababb}

G1:

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G4:

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G3:

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$A \rightarrow AA \mid a \mid \text{NULL}$

G4:

$S \rightarrow SS \mid a \mid b \mid \text{NULL}$



## *Example 3*

Alphabet = {0,1,2,3,4,5,6,7,8,9}

$L = \{0, 1, 2, \dots 21, 22, \dots 234234, \dots\}$

Grammar:

$N \rightarrow NN \mid D$

$D \rightarrow 0 \mid 1 \mid 2 \mid \dots \mid 8 \mid 9$

Is "00052 = 52" ?

$L = \{0, 00, 000, \dots 1, 01, 001, \dots 2, 02, 002, \dots 51, 051, 0051, \dots 25410, 025410, 0025410, \dots\}$

0052 = 52 ?

$L = \{0, 00, 000, \dots 1, 01, 001, \dots 2, 02, 002, \dots 51, 051, 0051, \dots 25410, 025410, 0025410, \dots \}$

# Vaisesika Ontology

Vaisesika Categories (padārtha-s)

dravya substance	guna quality	karma action	anānīya inertness	avasthā condition	abhidhāna denotation
padārtha substance -dravya-	padārtha quality -guna-	padārtha action -karma-	padārtha inertness -anānīya-	padārtha condition -avasthā-	abhidhāna denotation -abhidhāna-
dravya substance -dravya-	guna quality -guna-	karma action -karma-	anānīya inertness -anānīya-	avasthā condition -avasthā-	abhidhāna denotation -abhidhāna-
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Kanada, Vaisesika Sutra and Prasastapada, Bhasya

Some definitions

dravya (substance) is defined as follows in Kanada sutra-s (1.1.15):

“substance is that where qualities and actions exist, and also it is an inhering cause”

And then karma (action) is defined as follows in Kanada sutra-s (1.1.17):

“action is that which inheres in only one substance, is without qualities, and is the non-inhering cause of conjunctions and disjunctions”

# Vaiśeṣika Categories (*padārtha*-s)

<i>dravya</i> substance <9>	<i>guṇa</i> quality <24>	<i>karma</i> action <5>	<i>sāmānya</i> universal <2>	<i>viśeṣa</i> differentiator <infinite>	<i>samavāya</i> inherence <1>	<i>abhāva</i> absence <4>
<i>pṛthvī</i> earth <infinite>	<i>gandha</i> smell	<i>utkṣepaṇa</i> rising	<i>para</i> wide <1>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">mobile &amp; atomic</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">non-mobile</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">special qualities</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">general qualities</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">special qualities of self</div> <div style="border: 1px solid black; padding: 5px;">quality of self &amp; mobile</div>		<i>prāgābhāva</i> prior absence
<i>ap</i> water <infinite>	<i>rasa</i> Taste	<i>apakṣepaṇa</i> falling	[hierarchy] [structure]			<i>pradhvaṃsābhāva</i> posterior absence
<i>tejas</i> fire <infinite>	<i>rūpa</i> Color	<i>ākuñcana</i> contracting	<i>apara</i> narrow <indefinite>			<i>anyonyābhāva</i> reciprocal absence
<i>vāyu</i> wind <infinite>	<i>spṛśa</i> Touch	<i>prasāraṇa</i> expanding				<i>atayantābhāva</i> absolute absence
<i>ākāśa</i> medium <1>	<i>śabda</i> Sound	<i>gamana</i> locomotion				
<i>kāla</i> time <1>	<i>saṅkhyā</i> number					
<i>dik</i> expanse <1>	<i>parimāṇa</i> magnitude					
<i>ātman</i> self <infinite>	<i>pṛthaktva</i> otherness					
<i>manas</i> mind <infinite>	<i>saṅyoga</i> conjunct					
	<i>vibhāga</i> disjunct					
	<i>paratva</i> remoteness					
	<i>aparatva</i> proximity					
<i>buddhi</i> cognition	<i>Sukha</i> happiness	<i>duḥkha</i> misery	<i>icchā</i> desire	<i>dveṣa</i> aversion	<i>prayatna</i> volition	⇐ psychic qualities
<i>dharma</i> merit	<i>adharma</i> demerit	<i>saṅskāra</i> tendency	<i>gurutva</i> weight	<i>dravatva</i> fluidity	<i>sneha</i> viscosity	⇐ dispositional qualities

<#/infinite/indefinite> indicates number of sub-categories or number of entities in each substance

qualities grasped by one sense organ and their corresponding material substrates  
entities not explicitly listed by Kaṇāda but accepted as consistent with system

Logical Relation –  
1. attribute | attributee  
2. locus | located



## Some definitions

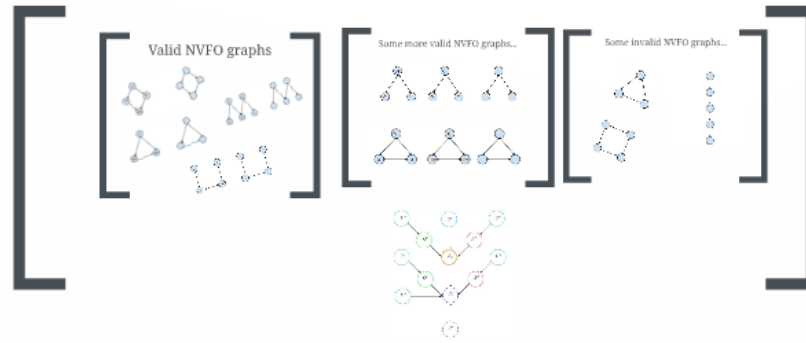
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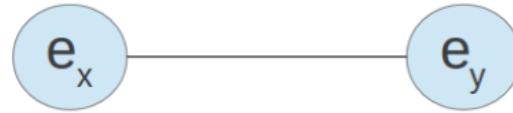
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# Neo-Vaisesika Formal Ontology

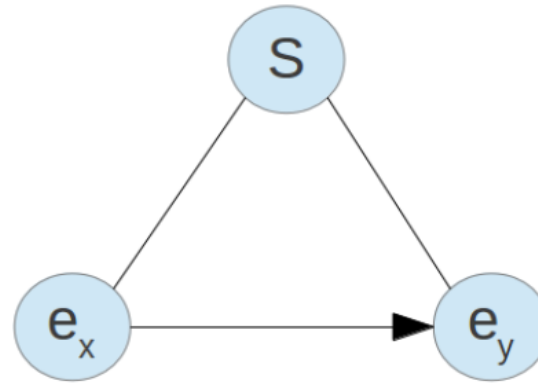


# Three Basic Punctuators

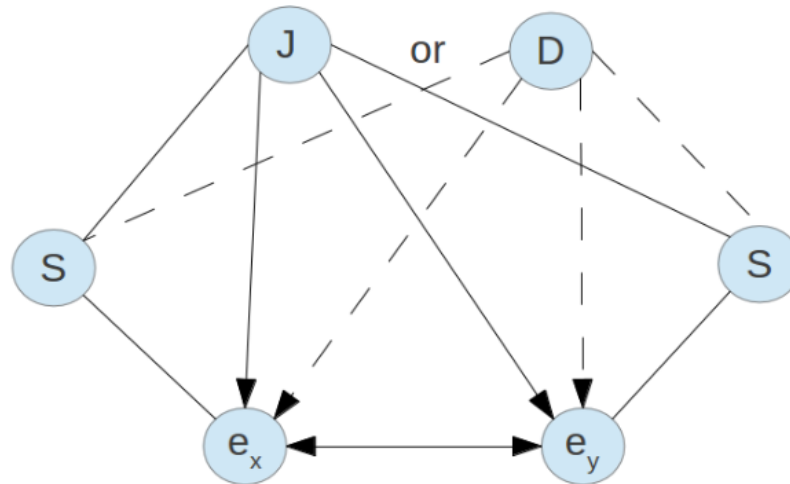
Svarupa



Samavaya



Samyoga



# Vaiśeṣika Categories (*padārtha*-s)

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Logical Relation –  
1. attribute | attributee  
2. locus | located

⇐ psychic qualities

⇐ dispositional qualities



The following Vaisesika categories are formally defined in NVFO:

- antya dravya (ultimate substance)
- murta dravya (mobile ultimate substance)
- vibhu (ubiquitous ultimate substance)
- avayavi (substantial whole)
- guna (quality)
- karma (action)
- samanya (universal)
- visesa (ultimate differentiator)

Again among dravya-s the following are defined:

- kala
- dik
- aakasa
- aatman
- manas

Ultimate Substance: That which inheres nowhere but that in which at least one entity inheres.

Visesa: That which inheres in one and only one ultimate substance, and nothing inheres in that.

Universal: That which inheres in at least two entities but nothing inheres in that.

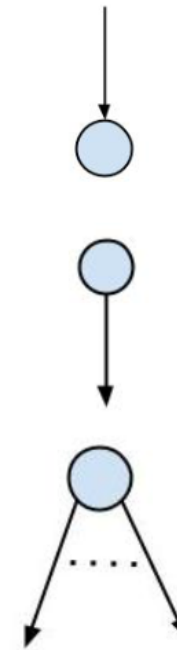
Ubiquitous ultimate substance: That which is in conjunct/disjunct with all other ultimate substances.

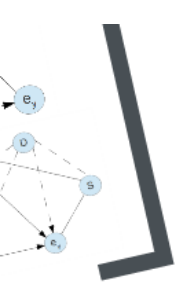
Mobile ultimate substances: Those ultimate substances which are not ubiquitous.

Action: That which inheres in mobile ultimate substances and is a condition for change in conjunct/disjunct.

Substantial Whole: That which is a condition for the combined change in conjunct/disjunct of a group of mobile ultimate substances by virtue of inhering in them.

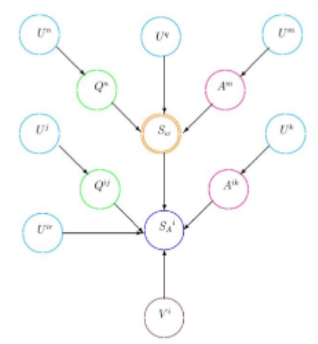
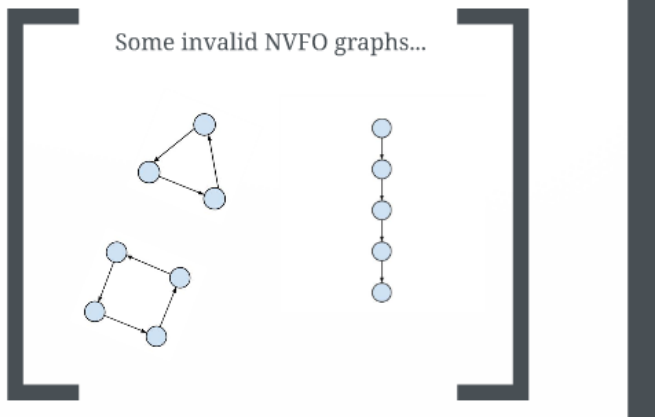
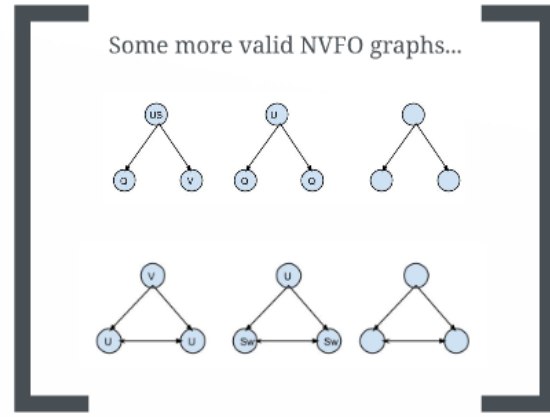
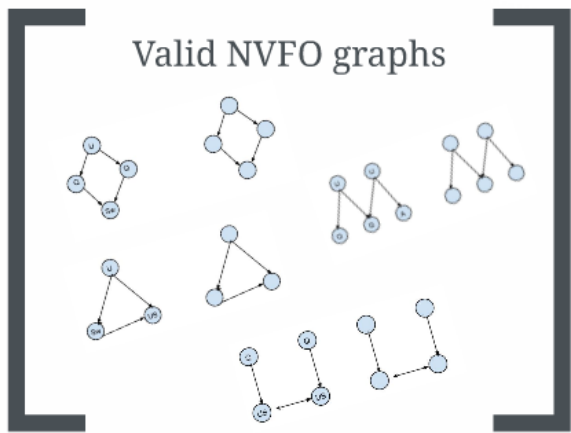
Qualities: All the remaining middle group entities are qualities.



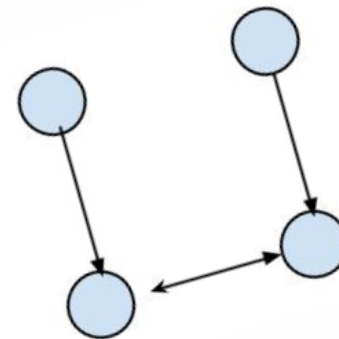
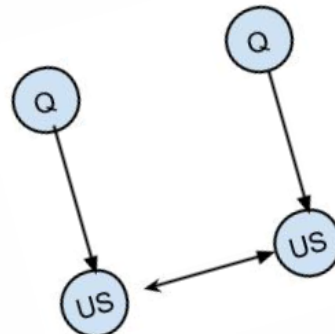
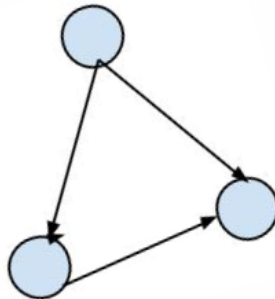
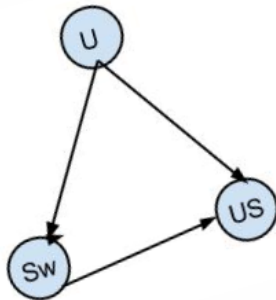
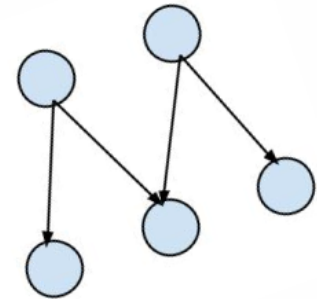
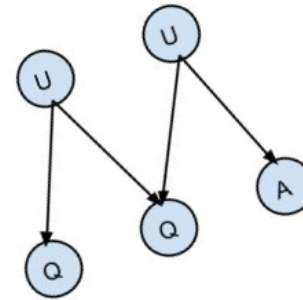
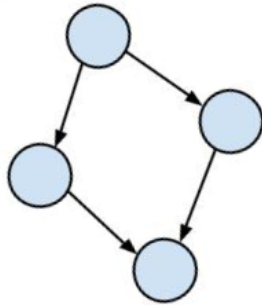
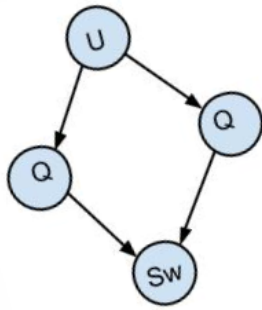


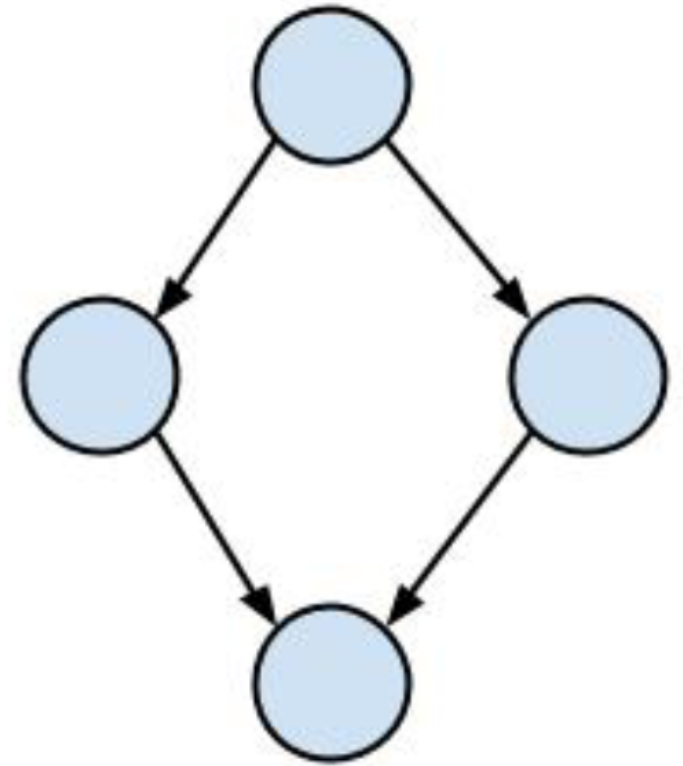
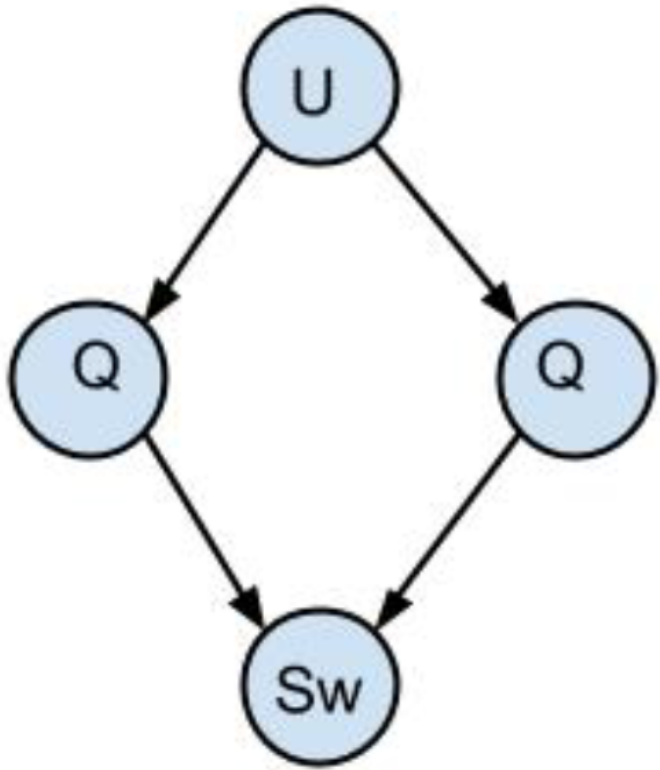
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- Again among dravyas-the following are defined:
- kala
  - dil
  - ashka
  - asman
  - manas

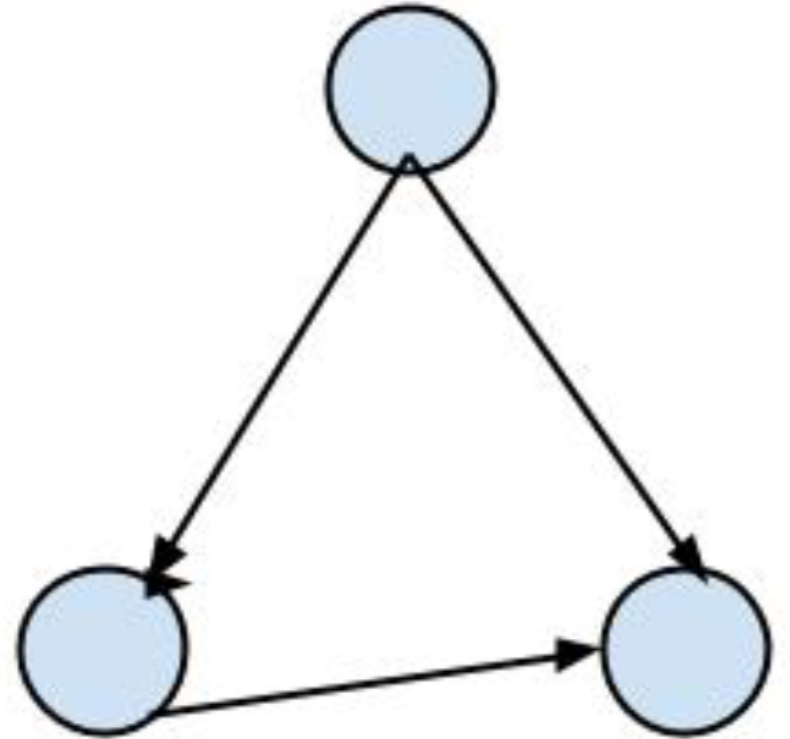
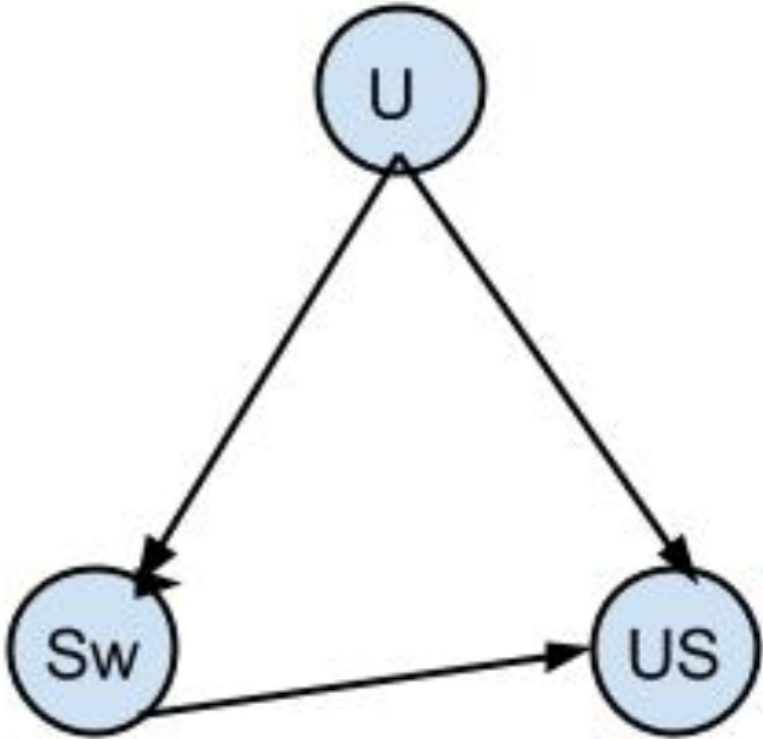
... and no  
 Universal: That which inheres in two entities but nothing in  
 Ubiquitous ultimate substance: That which is conjunct/disjunct with all other  
 Mobile ultimate substances: Those substances which are not ubiquitous  
 Action: That which inheres in matter and is a condition for change in  
 Substantial Whole: That which is combined change in conjunct/disjunct ultimate substances by virtue of its qualities.  
 Qualities: All the remaining middle

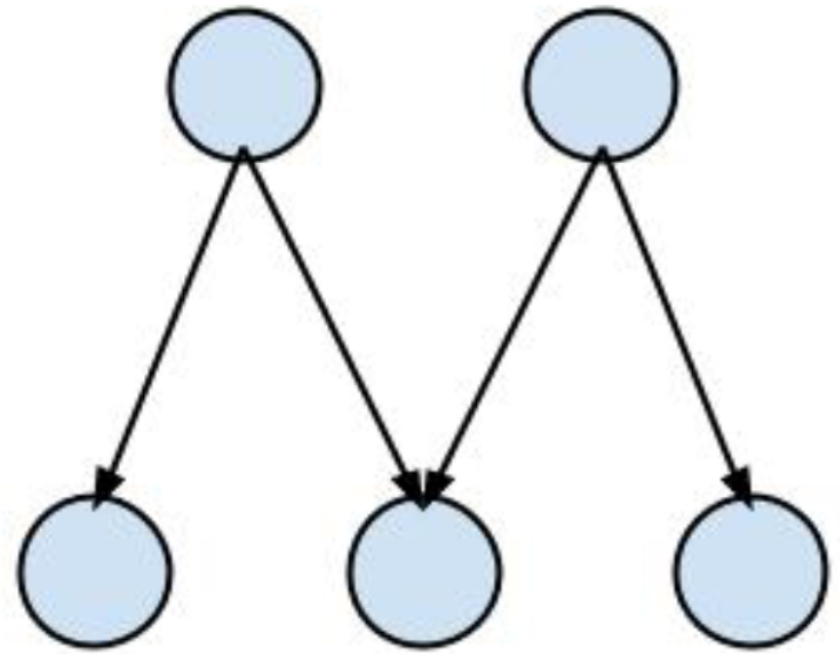
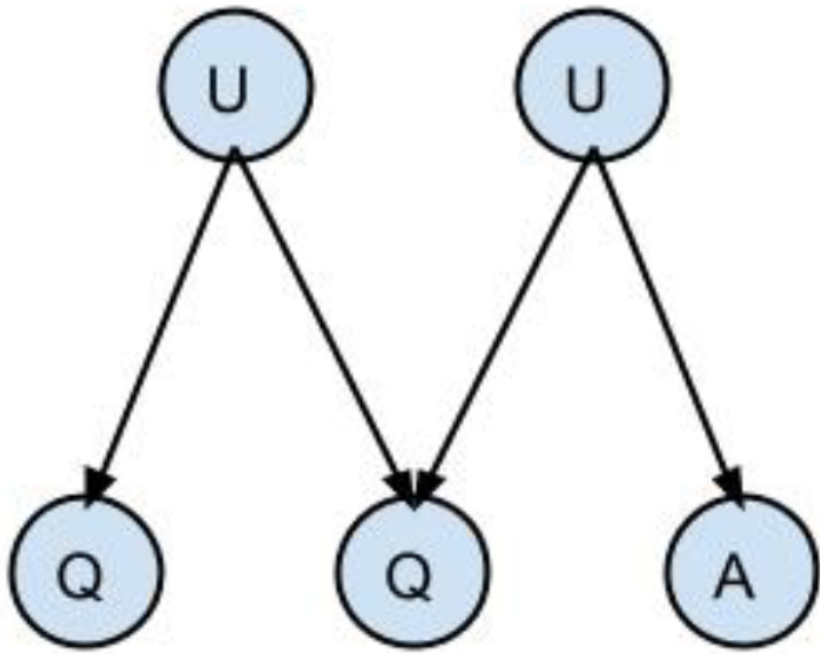


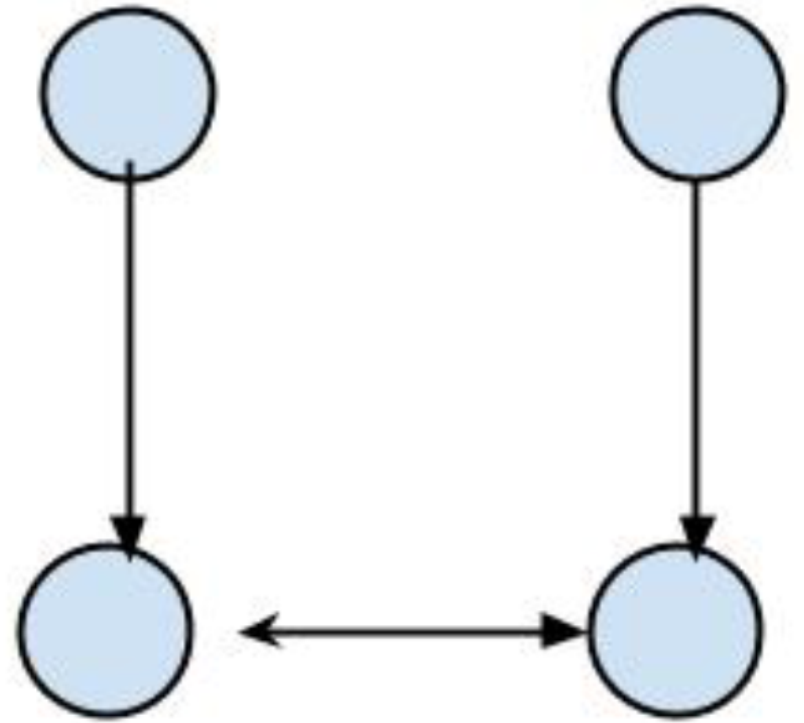
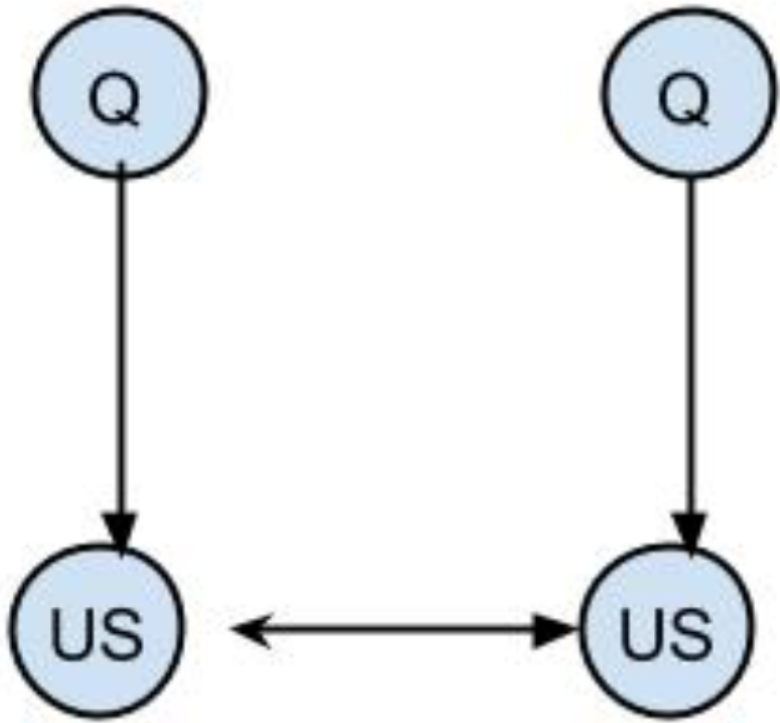
# Valid NVFO graphs





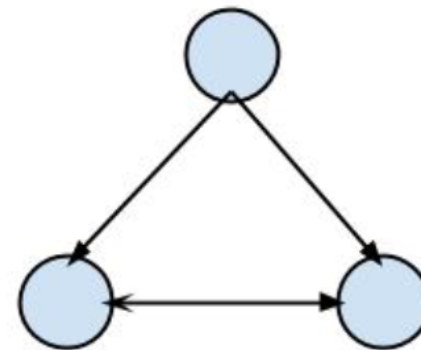
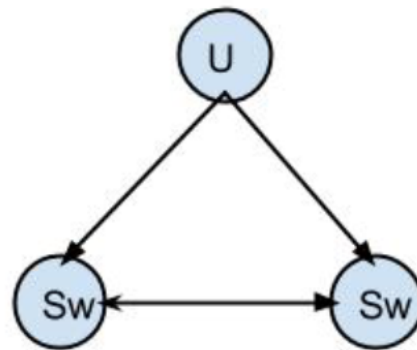
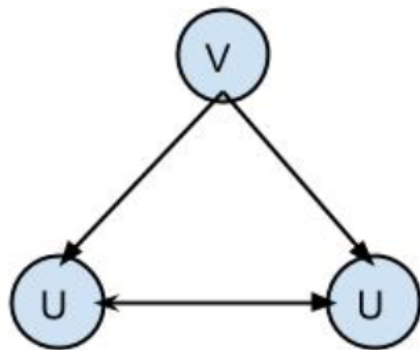
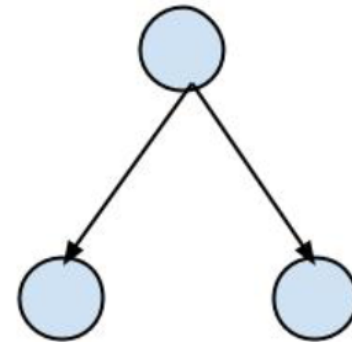
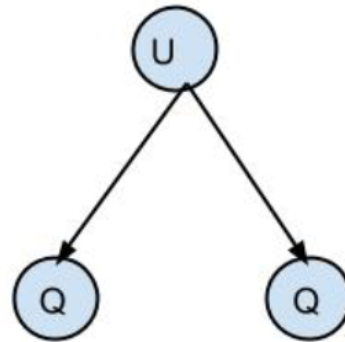
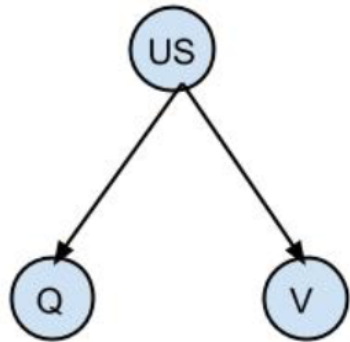




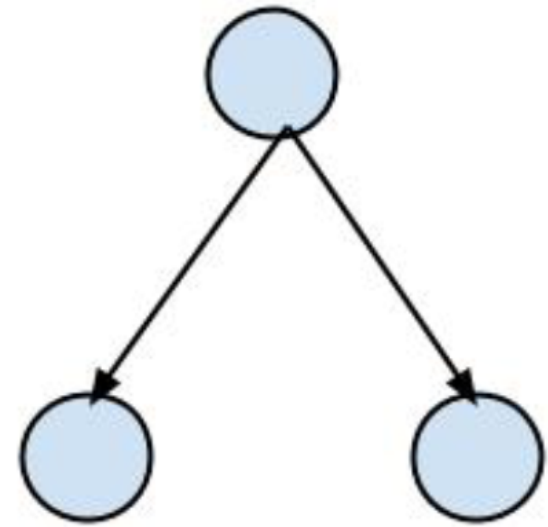
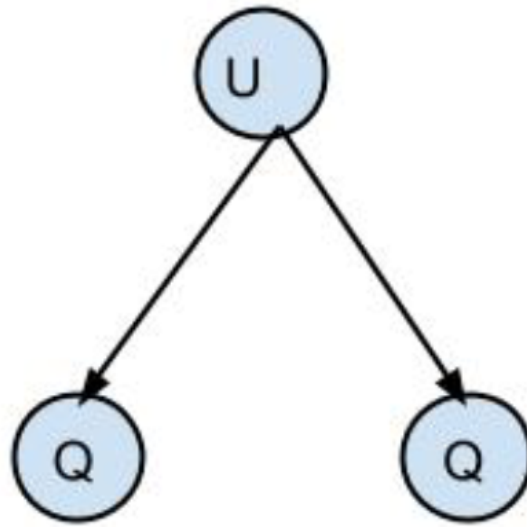
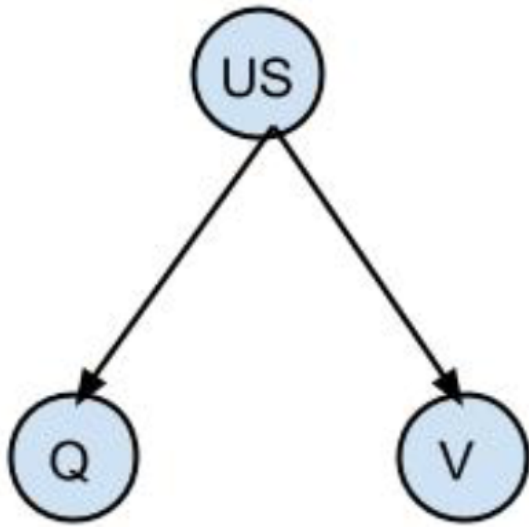


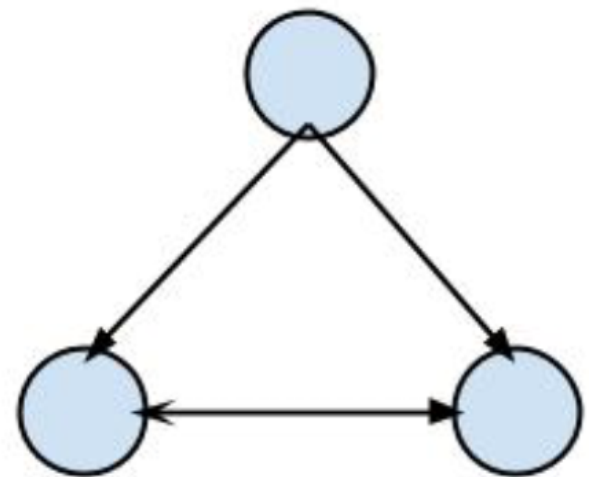
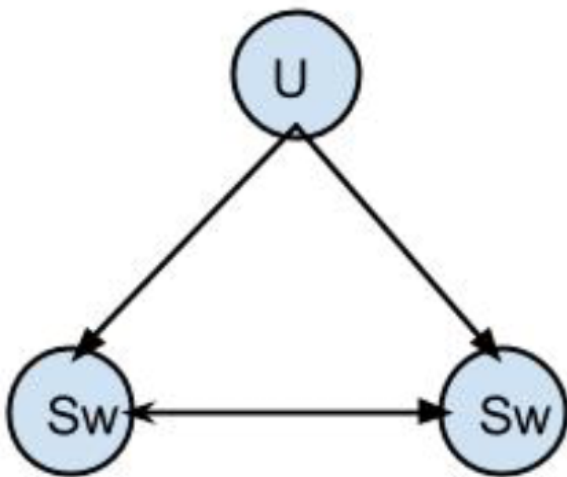
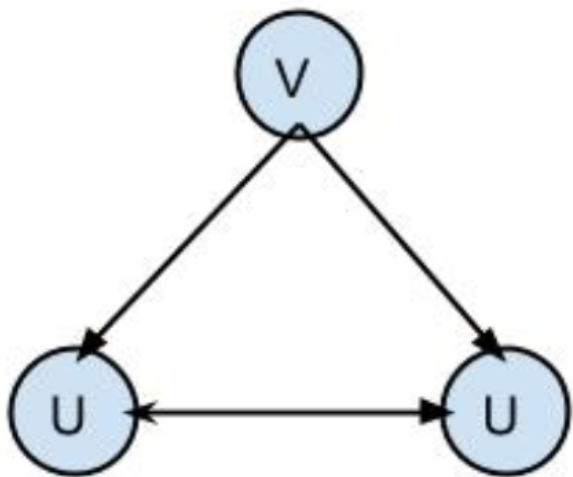


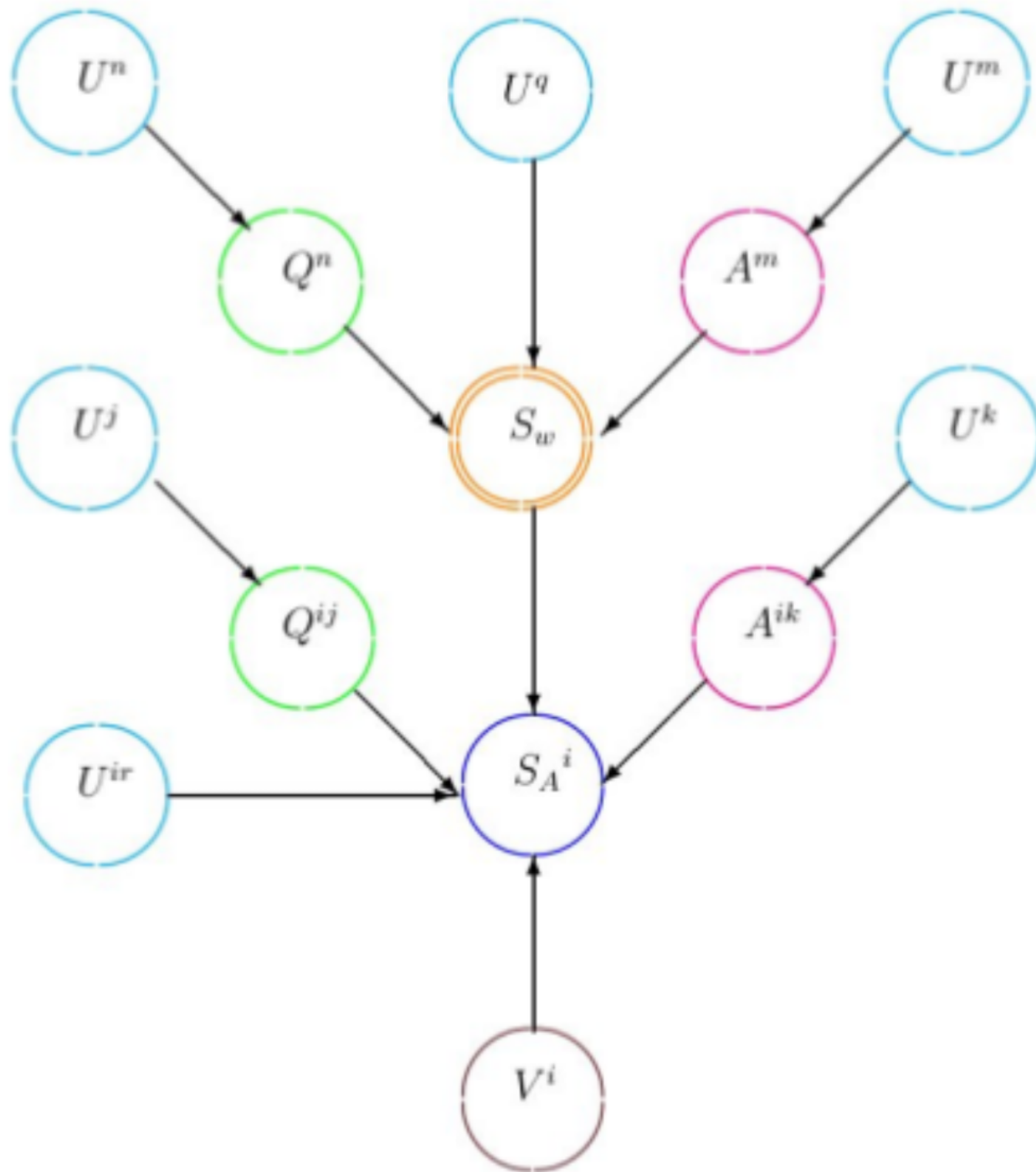
# Some more valid NVFO graphs...



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## G3 (Generative Graph Grammar software)

Covering only the following categories  
defined in NVFO

- antya dravya (ultimate substance)
- visesa (ultimate differentiator)
- samanya (universal)
- avayavi (substantial whole)
- guna (quality)

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